Report Information
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Shape based region growing using derivatives of 3D medical images: application to automatic detection of pulmonary nodules.

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Conference information
ISPA 2004. Proceedings of the 3rd International Symposium on Image and Signal Processing and Analysis, Rome, Italy, 18–20 Sept. 2003.
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Dehmeshki–J, Ye–X, Valdivieso–M, Roddie–M, Costello–J. Editor(s): Loncaric–S, Neri–A, Babic–H.

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Abstract
In general, an automatic lung nodule detection system consists of two stages: (1) detection of objects within lung images as potential nodules (2) classification of the detected objects into nodule and nonnodule classes. This paper addresses the first stage by introducing a new method for shape based **segmentation** of 3D lung images. Firstly, the 3D geometric features of each voxel are calculated by using the partial derivatives of the 3D image, e.g. the Gaussian and mean **curvature,** principal **curvatures,** and shape index; Secondly, the shape features of the isointensity surfaces are subsequently extracted; Finally, a hybrid methodology incorporating shape feature extraction and 3D intensity–based **region growing** is applied to give accurate separation of connected objects having different shapes but similar intensity **values.** The experimental results from six CT scans demonstrate that the proposed method yields a high performance of nodule detection, (30 nodules out of 33 were correctly detected, a detection rate of about 91%), with reasonable false positive (FP) (average FP is about 1.29/slice), which can be further reduced by the classification stage. Moreover, unlike the traditional intensity–based method, using the proposed shape based method all of the nodules can be separated accurately from adjoining blood vessels or from the lung wall.

Descriptors
BLOOD–VESSELS; COMPUTERISED–TOMOGRAPHY; FEATURE–EXTRACTION; GAUSSIAN–PROCESSES; IMAGE–RECOGNITION; **IMAGE–**SEGMENTATION; LUNG; MEDICAL–IMAGE–PROCESSING.

Classification codes
A8760J X–rays–and–particle–beams–medical–uses*;
A8770E Patient–diagnostic–methods–and–instrumentation;
A8745H Haemodynamics–pneumodynamics;
B7510P X–ray–techniques–radiography–and–computed–tomography–biomedical–imaging–measurement*;
B0240Z Other–topics–in–statistics;
B6135E Image–recognition;
C7330 Biology–and–medical–computing*;
C5260B Computer–vision–and–image–processing–techniques;
C1140Z Other–topics–in–statistics.

Keywords
3D–medical–images; pulmonary–nodules–automatic–detection; lung–image–**segmentation; Gaussian–**mean–curvature; **principal–**curvatures; isointensity–surfaces; hybrid–methodology; shape–feature–extraction; **3D–**intensity–based–region–growing; CT–scans; false–positive; blood–vessels.

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T Theoretical–or–mathematical.
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Retinal blood vessel segmentation by means of scale–space analysis and region growing.

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Medical Image Computing and Computer–Assisted Intervention – MICCAI'99. Second International Conference. Proceedings (Lecture Notes in Computer Science Vol.1679), 1999, p. 90–7, 7 refs, pp. xxi+1240, ISBN: 3–540–66503–X. Publisher: Springer–Verlag, Berlin, Germany.
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Martinez–Perez–M–E, Hughes–A–D, Stanton–A–V, Thom–S–A, Bharath–A–A, Parker–K–H. Editor(s): Taylor–C, Colchester–A.
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Martinez–Perez, M.E., Dept. of Biol. & Med. Syst., Imperial Coll. of Sci., Technol. & Med., London, UK.
Abstract
Presents a method for retinal blood vessel **segmentation** based upon the scale–space analysis of the first and second derivative of the intensity image, which gives information about its topology and overcomes the problem of variations in contrast inherent in these images. We use the local maxima over scales of the **magnitude** of the gradient and the maximum principal **curvature** as the two features used in a **region–**growing procedure. In the first stage, the **growth** is constrained to **regions** of low gradient **magnitude.** In the final stage, this constraint is relaxed to allow borders between **regions** to be defined. The algorithm is tested in both red–free and fluorescein retinal images.
Descriptors
BLOOD–VESSELS; DIFFERENTIATION; EYE; GRADIENT–METHODS; IMAGE–**SEGMENTATION;** MEDICAL–IMAGE–PROCESSING; OPTIMISATION; TOPOLOGY.
Classification codes
B7510J Optical–and–laser–radiation–biomedical–imaging–measurement*;
B6135 Optical–image–and–video–signal–processing;
B0260 Optimisation–techniques;
C7330 Biology–and–medical–computing*;
C5260B Computer–vision–and–image–processing–techniques;
C1180 Optimisation–techniques.
Keywords
retinal–blood–vessel–segmentation; scale–space–analysis; intensity–image–derivatives; topology; contrast–variations; local–maxima;

gradient–magnitude; **maximum–**principal–curvature; **region–**growing–procedure; constraint; **region–**borders; red–free–retinal–images; fluorescein–retinal–images.

Treatment codes
P Practical.

Language
English.

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Conference–paper.

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Search Strategy

No.	Database	Search term	Info added since	Results
1	INZZ	curvature$1 SAME (value$1 OR amplitude$1 OR magnitude$1) AND segment$5	unrestricted	245
2	INZZ	1 AND (region$1 NEAR grow$3 OR region–grow$3)	unrestricted	4

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